

PROCESS FOR DEPOSITING A POROUS, LOW DIELECTRIC CONSTANT SILICON OXIDE FILM

5

ABSTRACT OF THE DISCLOSURE

The present invention relates to a method for providing a dielectric film having a low dielectric constant that is particularly useful as an intermetal dielectric layer. The method of the present invention deposits a porous oxide gap fill layer from a process gas of ozone and TEOS. The gap fill layer is deposited over a surface sensitive lining layer (as opposed to a non-surface sensitive layer as is commonly done in the industry) using deposition conditions that maximize the amount of carbon that is incorporated into the gap fill layer and result in a porous silicon oxide film. A typical SACVD ozone/TEOS gap fill layer has a carbon content of about 2-3 atomic percent (at. %). An SACVD ozone/TEOS gap fill layer deposited according to the present, however, has a carbon content of at least 5 at.% and preferably has a carbon content of between about 7-8 at.%. Incorporating such a high carbon content into the porous SACVD gap fill layer helps stabilize the layer so it is not susceptible to moisture absorption and outgassing problems as is a lower carbon content porous SACVD ozone/TEOS film. In one embodiment, the method of the present invention increases the carbon content of the SACVD ozone/TEOS layer by depositing the layer at a temperature of less than 400°C and deposits a porous film over the surface sensitive layer by using a relatively high ozone to TEOS ratio. Silicon oxide films deposited according to the present invention have a dielectric constant of 3.2 and below and exhibit good film stability. Such films are particularly useful in sub-0.2 micron IMD applications.